The Use of E-Faciliatation in Teaching And Learning of Algebra Among Secondary Schools Students in Gwoza Local Government Area of Borno State, Nigeria.

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Abstract
This study investigated the use of e-faciliatation on Students' achievement in algebra at Gwoza local Government Area of Borno State Nigeria. The study adopted a quasi experimental design type. The study was based on six weeks of continuous interaction with the selected samples drawn from 35 secondary schools. Mathematics Achievement Test (MAT) was developed by the researcher which was duly validated. The reliability index was calculated using Kuder Richardson formula method (K-R 20) which gave 0.78.Two research questions were raised and three research Hypotheses were generated which were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA). Stratified random sampling technique was used in selecting the sample which consists of 105 participants. The experimental group comprises 32 male and 23 female participants. The control group comprises 28 male and 22 female participants. The results of the study revealed that participants who were taught using e-faciliatation performed better significantly than their counterparts taught with the conventional method, and that the female participants taught Using e-faciliatation also achieved better than the male counterparts. It was recommended that e-faciliatation should be infused by the Mathematics teachers when teaching algebra.

Keywords: e-faciliatation, teaching, algebra, secondary school and Student.

Introduction

Algebra is one of the main components of knowledge in mathematics subject that is taught around the world. Infact, it has been tested in all 79 participating countries of PISA,2018. Including Gwoza local Government Area of Borno State Nigeria (QECD,2019). Algebra is also a required course for many students majoring science, education, technology and mathematics (STEM) and its abstract nature can cause significant difficulties for students who struggle to grasp the more theoretical aspect of the course (Stewart et al.,2019). This is not surprising that the algebra is regarded as the main key to enter a higher level of education such as universities (Utami & Jupri, 2021).

In Gwoza local Government Area of Borno State Nigeria, algebra is integrated into the syllabus according to the specific chapters. In this regard, Algebra chapter for lower secondary mathematics are related with those that are taught in upper secondary schools where a number of algebra formula and problem solving that is learned in the former will be applied in problems solving during the latter. Therefore, it is important for students to be equipped with the strong fundamental in algebra so that the time and the effort are allotted by the teachers to teach new knowledge are not wasted in repeating the lower secondary lessons. (Aziz etc al.,2018).

Despite its importance, solving algebra remains as the most challenging Algebraic topic to mastered as compared to other contents in the Mathematics syllabus (Huel al.,2021). This is due to its suitability to be used as concept that best illustrates ideas through models that are realistic or similar to real life situations (Didis & Ebere, (2015). E-faciliatation is a seamless virtual environment for video facilitation. Algebra is the part mathematics in which letters and other general symbols are used to represent number and quantities in formulae.Student is a person engaged in learning, especially one enrolled in School/College, and Secondary School is an institution that provides secondary education.

Since time immemorial, mathematicians have been using various strategies to solve Algebraic problems.This has been further expanded with continuous research in the field of algebra, which begins from arithmetic equations and numerical strategies to algebra and symbols as well as the use of

visual or geometrical techniques. Kartz & Barton, (2007). Furthermore, the use of parabolic curve in constructions is also closely related to algebra (Yeow et al.2019). The students' failure to Master fundamental basic skills will fossilize incorrect concepts in their mind that, will affect future learning. This is parallel with Watt(2005) who posits that the students' difficulty to further their study into the science field at the university is closely related to their failure in mastering basic algebra skills (Majeed et al.,2021).

Digital literacy skills refer to the students' awareness of constructing new knowledge (Zan et al.,2021)., Multmedia materials can help students to understand abstract mathematical problems by seemingly participating in realistic problems using graphic, video, audio, animation, and graph materials. This statement is supported by a study that has been conducted by pradanaet al. (2020), which reported that use of digital media makes mathematics objects more dynamic and allows the students to explore their own learning, in line with the 21st century pedagogy. According to Hadaga. (2024). posited that e-facilitating improve students learning of polymonial equations, experimental students performed significantly better than control group.

In addition, one of the important aspects of e-faciliatation is problem-solving (Rizal et al., (2019). Peng et al., (2020) have also started that mastering of e - facilitation literacy by the current generation is the result of the interaction between the main elements namely the general skills in problem solving and technical skills that are related to e-faciliatation.

Statement of the Problem.

Although the topic algebra is considered important in the school curriculum, many students in Gwoza local Government Area of Borno State, Nigeria are still producing errors in finding final solution. This has sparked a major concern among researchers in recent times. It shows that many students in Gwoza local Government Area of Borno State Nigeria still think that Algebra is challenging and difficult topic. This issue is supported by many researchers who reported that the main reason why Gwoza local Government Area of Borno State Nigeria students often make mistakes in solving algebra is because they failed to clearly understand the question and often misunderstood the requirements of the question. In addition, the use of the 'unknown' in algebra confuses students, students face significant difficulty in understanding Algebraic language such as symbols, notations and Algebraic terms. This evident by the low performance of the students of Gwoza local Government Area of Borno State Nigeria.

Objectives of the Study

This study is aim at investigating the use of e-faciliatation in teaching and learning of algebra at Gwoza local Government Area of Borno State Nigeria. SpecificalIy, the objectives of the study are: -

1. To find out if there is significant difference in performance between the experimental and control groups before intervention (before using e-faciliatation)
2. To determine whether there is any significant difference in performance between the experimental and control groups after the intervention (after applying e-faciliatation).
3. To distinguish the performance base on male gender between the experimental and control groups.
4. To distinguish the performance base on female gender between the experimental and control groups.

Research Questions.

The following research questions guided the study:

1. What are the mean achievement scores of the participant taught algebra in the experimental group and those taught algebras in the control group before and after the intervention?
2. What are the mean achievement scores of male and female participants taught algebra using e-faciliatation and those taught using conventional method before and after intervention?

Research Hypotheses

The null research Hypotheses that were generated for this study are:

Ho1 There is no significant difference in the mean achievement scores of participants taught algebra using e-faciliatation and those taught using conventional method.

Ho2 The no significant difference in the mean achievement scores of male and female participants in the experimental group.

Ho3 The is no significant interaction effects in method and gender on the achievement scores of participants in algebra.

Method

The design of the study was pretest -posttest quasi-experimental design. The population of the study comprised 1150 Senior Secondary School (S.S.S.1) Science Students in 35 Secondary Schools in Gwoza local Government Area of Borno State Nigeria which were sampled using stratified random sampling. The sample size for this Study was S.S.S.1 Science Students referred to as participants one hundred and five (105) S.S.S.1 Science Students referred to as participants in two selected Co-educational Secondary Schools in Gwoza local Government Area of Borno State This two selected schools were stratified and randomly from the thirty five schools in Gwoza local Government Area of Borno State Nigeria. The sample selected were grouped into experimental and control groups. The experimental group were taught using e-faciliatation while the control group were taught using conventional method. The experimental group comprised 55 participants. The control group comprised 50 Participants. The study was based on six weeks of continuous interactions. The instrument used in this study was Mathematics Achievement Test (MAT) which underwent face and content validation. MAT was used for pretest and post-test to collect data from participants. The reliability index was calculated using Kuder Richardson formula method (K-R 20), which gave 0.78. The instrument was administered on the participants during the first week as pretest. Then, four weeks was used to teach the experimental group and control groups. After the treatment, the concluding week (i.e 6th week) was used to administer the protest. This study engaged the experimental group with e-faciliatation to boost their learning rate and achievement in algebra. The researcher made use of e-faciliatation materials..The research Hypotheses were tested at 0.05 alpha level using Analysis of covariance (ANCOVA).

Data Analysis

Research Question 1

What are the mean achievement scores of participants taught algebra in the experimental group and those taught algebras in the control group before and after the intervention?

Table 1: Mean achievement scores and standard deviation of participants taught algebra in experimental and control groups before and after intervention.

Groups	Number	Pretest		Posttest	
		Mean	Standard Deviation	Mean	Standard Deviation
Experimental	55	5.76	1.122	8.49	1.332
Control	50	5.06	1.219	7.34	1.479

Table 1 showed the mean achievement scores and standard deviation of the experimental and control groups in both pretest and post-test. From the results analyzed in the table, the pretest mean achievement score and standard deviation for the experimental group was 5.76 and 1.122 respectively, while the post-test mean achievement scores and standard deviation were 8.49 and 1.332 respectively. In the same vein, for the control group, pretest mean achievement scores and standard deviation were 5.06 and 1.219 respectively, while the post-test mean achievement scores and standard deviation were 7.34 and 1.479 respectively.which is inline with the study of Hadaga and Stewart

Research Question 2

What are the mean achievement scores of male and female participants taught algebra using e-faciliatation and those taught algebra using conventional method before and after intervention?

Table 2: Mean achievement scores of male and female participants in experimental and control groups.

Groups	Gender	Number	Pretest Mean	Pretest Standard Deviation	Posttest Mean	Posttest Standard Deviation
Experimental	Male	32	5.50	1.164	8.41	1.341
	Female	23	6.13	0.968	8.61	1.340
			Pretest Mean	Standard Deviation	**Posttest** Mean	Standard Deviation
Control	Male	28	5.18	1.389	7.39	1.641
	Female	22	4.91	0.971	7.27	1.279

Table 2 showed the mean achievement scores and standard deviation of male and female participants in the experimental and control groups in both pretest and post-test. From the results analyzed in the table, the pretest mean achievement scores and standard deviation for the male participants in experimental group were 5.50 and 1.164 respectively. In the control group, the pretest mean achievement scores and standard deviation for male participants were 5.18 and 1.389 respectively.Which agree with the study of Utami and Jupri.

In the same vein, the pretest mean achievement scores and standard deviation for female participants in experimental group were 6.13 and 0.968 respectively. In control group, the pretest mean achievement scores and standard deviation for female participants were 4.91 and 0.971 respectively. This is in agreement with the study of Hu and Didis. Also, the post-test mean achievement scores and standard deviation for the male participants in experimental group were 8.41.and 1.341 respectively. In the control group, the post-test mean achievement scores and standard deviation for male participants were 7.39 and 1.641 respectively, this is inline with the study of Kartz and Barron.

Furthermore, the protest mean Achievement scores and standard deviation for female participants in the experimental group were 8.61 and 1.340 respectively. In the control group, the protest mean Achievement scores and standard deviation for the Female participants were 7.27 and 1.279 respectively.This is inline with the study of Yeow. It can thus be deduced that the male and female participants in the experimental group had a higher mean scores than those in the control group. Furthermore, the female participants had higher pretest and posttest mean scores than their male counterparts in the experimental group, though there was little gap in their posttest standard deviation scores.

Testing of Research Hypotheses

The Hypotheses were tested at 0.05 level of significance using Analysis of Covariance(ANCOVA). The results are displayed in Table 3,4 and 5 below.

Hypotheses 1: There is no significant difference in the mean achievement scores of participants taught algebra using e-faciliatation and those taught using conventional method.

Table 3: Analysis of Covariance on the mean achievement scores of participants taught algebra using e-faciliatation and those taught using conventional method.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	73.952[a]	1	73.952	95.497	.000	Ho rejected
Intercept	3.621	1	3.621	4.676	.033	
GROUP	73.952	1	73.952	95.497	.000	
Error	79.762	103	.774			
Total	3248.000	105				
Corrected Total	153.714	104				

Table 3 showed the Analysis of Covariance (ANCOVA) on the mean achievement scores of students in experimental and control groups. In Table 3, groups(experimental and control) as the main effect, gave an f- value of 95.497 and was significant at 0.000.since 0.000 was less than 0.05, this means that at 0.05 level of significance, the f-value was significant. Hence, hypothesis 1 was rejected as stated. The study therefore concluded that there was indeed significant difference between the mean achievement scores of participants taught algebra using e-faciliatation and those taught using conventional method. This gives an indication that those taught with the e-faciliatation achieved better than those taught with conventional method.

Hypotheses 2: There is no significant difference in the mean achievement scores of male and female participants in the experimental group.

Table 4: Analysis of Covariance on the mean achievement scores of male and female participants in the experimental group.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	6.729[a]	1	6.729	5.827	.019	Ho rejected
Intercept	16.001	1	16.001	13.857	.000	
GENDER	6.729	1	6.729	5.827	.019	
Error	61.199	53	1.155			
Total	1895.000	55				
Corrected Total	67.927	54				

Table 4 Showed through Analysis of Covariance (ANCOVA), the mean achievement scores of male and female achievement scores in the experimental group. In Table 4, gender (male and female) as main effect, gave an f-value of 6.729 and significant at 0.019. Since 0.019 was less than 0.05, this meant that at 0.05 significant level , the f-value was significant. Hence, Hypotheses 2was rejected as stated. Thus, the study concluded that there was no significant difference between the mean achievement scores of male and female participants in the experimental group. This gives an indication that the female participants achieved better than the male participants in the experimental this is inline Pradanaet

Hypotheses 3: There no significant interaction effect in strategies and gender on achievement scores of participants in algebra.

Table 5: Analysis of Covariance (ANCOVA) on the interaction between strategy and gender on the achievement scores of participants in algebra.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	36.909[a]	2	18.455	9.377	.000	Ho rejected
Intercept	83.596	1	83.596	42.475	.000	
GENDER * GROUP	36.909	2	18.455	9.377	.000	
Error	200.748	102	1.968			
Total	6862.000	105				
Corrected Total	237.657	104				

Table 5 above show the interaction effect strategy and gender on the achievement scores of the participants in algebra. The results indicated that the main interaction effect gave an f-value of 18.455 and was significant at 0.000. Since was less than 0.05, this means that at 0.05 level of significance, the f-value of 18.455 was significant. It therefore followed that Hypotheses 3 was rejected. This implies that the strategy influenced significantly the achievement scores of participants in algebra. This study therefore concluded that there was significant interaction between gender and strategies on the achievement scores of the participants in algebra, this is inline with the study of Rizal and Peng.

Discussion of the findings

The results collated from the table 1 revealed that the experimental group's pretest and posttest mean scores of 5.76 and 8.49 respectively are great than the control group's pretest and posttest mean scores of 5.06 and this implies that the participants in the experimental group generally performed better than those in the control group .In pretest, the mean scores and standard deviation of the experimental group are 5.76 and 1.122 while the mean scores and standard deviation of the control group are 5.06 and 1.219 respectively. The standard deviation of the control group is slightly higher than the standard deviation of the experimental group. The difference in the mean scores of the experimental group and control group in the pretest is 5.76-5.06=0.70. In the protest, the mean scores and standard deviation of the experimental group are 8.49 and 1.332, while the mean scores and standard deviation of the control group are 7.34 and 1.479 respectively. The standard deviation of the control group is slightly higher than the standard deviation of the experimental group. The difference is the mean scores the experimental group and control group after intervention is8.49-7.34=1.15.

The results collated from the table 2 revealed that the male and female participants in the experimental group performed better than those in the control group. The scores and standard deviation of the male participants in the experimental group in the protest are 8.41 and 1.341 while the posttest mean score and standard deviation of the male participants in the control group are 7.39 and 1.641 respectively. The standard deviation of the control group is slightly higher than the standard

deviation of the experimental group. The difference in the protest mean scores of the male participants in the experimental group and the control group is 8.41-7.39=1.02. The protest mean scores and standard deviation of female participants in the experimental group are 7.27 and 1.279 respectively. The standard deviation of the experimental group is slightly higher than the standard deviation of the control group. The difference in the protest mean scores of the female participants in the experimental group and the control group after intervention is 8.61-7.27=1.34. It is also noticed that the female participants in the experimental group have a slightly higher posttest mean score(8.61) over their male counterparts(8.41) and is slightly lower standard deviation (1.340) compared to their male counterparts (1.341).

Table 3 examined the Analysis of Covariance (ANCOVA) on the mean achievement scores of participants in experimental and control groups. It was established in table III that there was significant difference between the mean achievement scores of participants taught using e-faciliatation and those taught using conventional method. Since the experimental group achieved better in teaching and learning Algebra, it is therefore mean that the e-faciliatation make students achieve better in algebra

Table 4 show that there was significant difference between the mean scores of male and female participants taught with the e-faciliatation, and since the female participants achieved better than the male participants in the experimental group, it therefore mean that female participants taught with e-faciliatation perform better than their male counterparts taught with the same method.This is inline with the study of Majeed. Table 5 went further to reveal that there was significant interaction between gender and method on the achievement scores of participants in algebra. Since the male and female participants in the experimental group generally performed better than the male and female in the control group, it therefore mean that, not only was there increased achievement rate of participants using e-faciliatation as compared with those with conventional method, there was also a significant increase in gender performance as a result.

Conclusion

The results from this study clearly attest to the fact that e-faciliatation is useful in enhancing students' performance in algebra when is adopted by mathematics teacher. Several researchers revealed that students had a positive view about the use of e-faciliatation. This positive students' perception of e-faciliatation is consistent with the findings of this study. Therefore, this study concluded that a significance difference exists in the performance of students in the experimental group compared to control group, and that the male and female participants in the experimental group performed significantly better than the male and female participants in the control group.

Recommendations

1. E-faciliatation method should be infused by the Mathematics teachers when teaching algebra.
2. Regular in-service training should be organized at the school level to introduce the Mathematics teachers to New ways of e-faciliatation of teaching algebra.
3. Parents should monitor their wards and children closely when they work with e-faciliatation materials.
4. Government should endeavor to provide Mathematics teachers and students with e-faciliatation materials/tools for classroom instruction at a subsidized rate.

Reference

Aziz, T. A., Pramudiani, P., & Purnomo, Y. W. (2018). Differences between quadratic equations and functions: Indonesian pre-service secondary mathematics teachers' views. Journal of Physics: Conference Series, 948(1), 012043. https://doi.org/10.1088/1742-6596/948/1/012043.

Didis, M. G., & Erbas, A. K. (2015). Performance and difficulties of students in formulating and solving quadratic equations with one unknown. Educational Sciences: Theory & Practice, 15(4), 1137-1150. https://doi.org/ 10.12738/estp.2015.4.2743

Hadaga, Y.B. (2024). The use of e-facilitating in teaching and learning polynomial equation.

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Hu, Q., Son, J. W., & Hodge, L. (2021). Algebra teachers' interpretation and responses to student errors in solving quadratic equations. International Journal of Science and Mathematics Education, 20(3), 637-657. https://doi.org/10.1007/s10763-021-10166-1

Katz, V., & Barton, B. (2007). Stages in the history of algebra with implications for teaching. Educational Studies in Mathematics, 66, 185-201. https://doi.org/10.1007/s10649-006-9023-7

Majid, M. A. A., Othman, M., Mohamad, S. F., Lim, S. A. H., & Yusof, A. (2017). Piloting for interviews in qualitative research: Operationalization and lessons learnt. International Journal of Academic Research in Business and Social Sciences, 7(4), 1073-1080. https://doi.org/10.6007/IJARBSS/v7-i4/2916

OECD. (2019). PISA 2018 assessment and analytical framework. Organisation for Economic Co-operation and Development. https://www.oecd-ilibrary.org/education/pisa-2018-assessment-and-analytical-framework _b25efab8-en

Peng, L. Y., Luan, W. S., Ayub, A. F. M., & Ling, W. S. (2020). Hubungan di antara strategi pembelajaran dengan literasi teknologi maklumat dan komunikasi pelajar prasiswazah [The relationship between learning strategies and information technology literacy and communication of undergraduate students]. Malaysian Journal of Education, 45(1), 1-11. https://doi.org/10.17576/JPEN-2020-45.01-01

Pradana, L., Sholikhah, O., Maharani, S., & Kholid, M. (2020). Virtual mathematics kits (VMK): Connecting digital media to mathematical literacy. International Journal of Emerging Technologies in Learning, 15(3), 234-241. https://doi.org/10.3991/ijet.v15i03.11674

Rizal, R., Setiawan, W., & Rusdiana, D. (2019, February). Digital literacy of preservice science teacher. Journal of Physics: Conference Series, 1157(2), 022058. https://doi.org/10.1088/1742-6596/1157/2/022058

Stewart, S., Andrews-Larson, C., & Zandieh, M. (2019). Linear algebra teaching and learning: Themes from recent research and evolving research priorities. ZDM, 51(7), 1017-1030. https://10.1007/s11858-019- 01104-1

van Laar, E., van Deursen, A. J., van Dijk, J. A., & de Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. Computers in Human Behavior, 72, 577-588. https://doi.org/10. 1016/j.chb.2017.03.010

Watt, H. M. G. (2005). Exploring adolescent motivations for pursuing maths-related careers. Australian Journal of Educational and Developmental Psychology, 5, 107-116. https://files.eric.ed.gov/fulltext/EJ815605.pdf

Yeow, P. C., Thavamani, R., Kamalah, R., Wong, J. W., & Santhanasamy V. D. (2019). Buku teks matematik tingkatan empat [Fourth grade math textbook]. Pustaka Yakin Press.

Zan, B., Colaklar, H., Altay, A., & Taskin, N. (2021). A study on digital literacy skills of faculty of letters students: Use of university library. International Journal of Emerging Technologies in Learning, 16(1), 152-171. https://doi.org/10.3991/ijet.v16i01.16567